4/

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/783,201	02/19/2004	Ken Museth	7975-0056/CIT-3849	6686

30076 7590 10/05/2006

BROWN RAYSMAN MILLSTEIN FELDER & STEINER, LLP
1880 CENTURY PARK EAST
12TH FLOOR
LOS ANGELES, CA 90067

EXAMINER	
BROOME, SAID A	
ART UNIT	PAPER NUMBER
2628	

DATE MAILED: 10/05/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 10/783,201	Applicant(s) MUSETH ET AL.
	Examiner Said Broome	Art Unit 2628

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on 19 February 2003.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 1-55 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 1-55 is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on 19 February 2004 is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Drawings

The drawings are objected to under 37 CFR 1.83(a) because they fail to show the subject matter in regards to Figures 5-10, as described in the Specification on page 18 lines 12-23 – page 19 lines 1-6, page 20 lines 7-12, and on page 21 lines 16-23. Any structural detail that is essential for a proper understanding of the disclosed invention should be shown in the drawing. MPEP § 608.02(d). Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as "amended." If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Claim Objections

Claims 4 and 5 are objected to because of the following informalities: The statement "...with by using...", is presented in an incorrect grammatical form. Appropriate correction is required.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 8-19 and 54 are rejected under 35 U.S.C. 112 second paragraph. The terms "$F(x,n,\Phi)$..." are relative terms which render the claims indefinite. The terms are not defined by the claim, the specification does not provide a standard for ascertaining the requisite degree, and one of ordinary skill in the art would not be reasonably apprised of the scope of the invention.

Claim Rejections - 35 USC § 101

35 U.S.C. 101 reads as follows:

> Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

Claims 1-55 are rejected under 35 U.S.C. 101 because the claimed invention is directed to non-statutory subject matter. Claims 1 recites: "A method for editing a geometric model...", however no tangible result is produced. Therefore, the claimed invention does not posses "real world" value, and instead represents nothing more than a process of modifying the surface of a geometric model. The tangible requirement does not necessarily mean that a claim must either

be tied to a particular machine or apparatus or must operate to change articles or materials to a different state or thing. However, the tangible requirement does require that the claim must recite more than a § 101 judicial exception, in that the process claim must set forth a practical application of that § 101 judicial exception to produce a real-world result. Benson, 409 U.S. at 71-72, 175 USPQ at 676-77 (invention ineligible because had "no substantial practical application.").

In State Street, the Federal Circuit examined some of its prior section 101 cases, observing that the claimed inventions in those cases were each for a "practical application of an abstract idea" because the elements of the invention operated to produce a "useful, concrete and tangible result." State Street, 149 F.3d at 1373-74, 47 USPQ2d at 1601-02. For example, the court in State Street noted that the claimed invention in Alappat "constituted a practical application of an abstract idea (a mathematical algorithm, formula, or calculation), because it produced 'a useful, concrete and tangible result'—the smooth waveform." Id. Similarly, the claimed invention in Arrhythmia "constituted a practical application of an abstract idea (a mathematical algorithm, formula, or calculation), because it corresponded to a useful, concrete and tangible thing—the condition of a patient's heart."

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1-3, 5, 45, 46, 48 and 51-53 are rejected under 35 U.S.C. 102(b) as being anticipated by Whitaker et al.(hereinafter "Whitaker", "*A Framework for Level Set Segmentation of Volume Datasets*").

Regarding claim 1, Whitaker describes a method for editing a geometrical model with a level set modeling surface editor operator in the abstract lines 1-8 ("*This paper presents a framework for extracting surface models from a broad variety of volumetric datasets...The level set segmentation method, which is well documented in the literature, creates a new volume from the input data by solving an initial-value partial differential equation (PDE) with user-defined feature-extracting terms.*"). Whitaker also describes performing a level set surface editing operation on a level set model, where the operation is defined by a level surface editing operator in section 3 second paragraph lines 3-10 ("*The surfaces are viewed as a specific level set of a higher-dimensional function Φ – hence the name level set methods. These methods provide the mathematical and numerical mechanisms for computing surface deformations...the level set formulation provides a set of numerical methods that describes how to manipulate the greyscale values in a volume, so that the isosurfaces of Φ move...*"), in section 4.2 first paragraph lines 1-10 ("*...the surface deformation process moves the surface model toward specific features in the data...the deformation process combines a data term with a smoothing term, which prevents the solution from fitting too closely to noise-corrupted data. There are a variety of surface-motion terms that can be used...*"), and as shown in Figure 5.

Regarding claim 2, Whitaker illustrates converting an input model into said level set model for said step of performing a level set surface editing operation in Figure 6, where it is shown that the input model is modified to produce, and therefore render, a level set model.

Regarding claim 3, Whitaker describes converting the input model from a geometric to a volumetric model by using scan conversion on page 5 left column first paragraph lines 9-10 ("*The user then creates a Constructive Solid Geometry (CSG) model which defines the shape of the initial surface...The CSG model is scan-converted into a binary volume...*").

Regarding claim 5, Whitaker describes converting the input model using Sethian's Fast Marching Method in section 3 right column fourth paragraph lines 3-4 ("*This static level set approach has been solved...using a "Fast Marching Method".*").

Regarding claim 45, Whitaker describes the level surface editing operator is a morphological editing operator in section 4.1.1 right column third paragraph lines 1-5 ("*For the results in the paper we implement openings and closings using morphological propagators... implemented with level set surface models.*").

Regarding claim 46, Whitaker describes volume rendering in the abstract lines 5-8 ("*The level set segmentation method...creates a new volume from the input data by solving an initial-value partial differential equation (PDE) with user-defined feature-extracting terms.*"), and the rendered volume is also shown in Figure 6.

Regarding claim 48, Whitaker describes the input model as a 3D object in the abstract lines 1-3 ("*This paper presents a framework for extracting surface models from a broad variety of volumetric datasets. These datasets are produced from standard 3D imaging devices...*"), and can therefore be a polygon mesh as shown in Figure 2b.

Regarding claim 51, Whitaker describes that the input model may be a Constructive Solid Geometry (CSG) model on page 5 left column first paragraph lines 9-10 ("*The user then creates*

a Constructive Solid Geometry (CSG) model which defines the shape of the initial surface…"), and as shown in Figure 7.

Regarding claim 52, Whitaker describes that the 3D models, which are input, as described in the abstract lines 5-8 ("*The level set segmentation method…creates a new volume from the input data…*"), are represented using implicit models, as described in section 3 first paragraph lines 1-6 ("*When considering deformable models for segmenting 3D volume data, one is faced with a choice from a variety of surface representations…Another option is an implicit level set model…*"), and as illustrated in Figure 5.

Regarding claim 53, Whitaker describes input models as a scanned volume in the abstract lines 1-5 ("*This paper presents a framework for extracting surface models from a broad variety of volumetric datasets. These datasets are produced from standard 3D imaging devices…*"), and as shown in Figures 1-4.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 4, 6 and 20-22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Whitaker in view of Breen et al.(hereinafter "Breen", "*3D Scan Conversion of CSG Models into Distance Volumes*").

Regarding claim 4, Whitaker fails to teach the limitations. Breen teaches converting an input model by using distance calculations in section 1 right column second paragraph lines 1-7 (*"When 3-D scan converting a geometric model to a volumetric representation…we propose the use of distance volumes. A distance volume is a volume dataset where the value stored at each voxel is the shortest distance to the surface of the object being represented by the volume."*). It would have been obvious to one of ordinary skill in the art to combine the teachings of Whitaker with Breen because this combination would provide accurate conversion of input geometric models into volumetric models through calculation of distances between points or voxels of the data.

Regarding claim 6, Whitaker fails to teach the limitations. Breen teaches the level set model is represented in a narrow-band distance volume in section 3.2.1 second paragraph lines 1-11 (*"Sethian…has developed a Fast Marching Level Set Method…The distance values in the remainder of the volume are computed by pushing this narrow band outward."*), where it is described that the level set method applied to the model is represented using narrow band distance values of the volume. The motivation to combine the teachings of Whitaker and Breen is equivalent to the motivation of claim 4.

Regarding claim 20, Whitaker fails to teach the limitations. Breen teaches the level surface editing operator is a CSG intersection operator in Table 2. The motivation to combine the teachings of Whitaker and Breen is equivalent to the motivation of claim 4.

Regarding claim 21, Whitaker fails to teach the limitations. Breen teaches the level surface editing operator is a CSG difference operator in Tables 3 and 4. The motivation to combine the teachings of Whitaker and Breen is equivalent to the motivation of claim 4.

Regarding claim 22, Whitaker fails to teach the limitations. Breen teaches the level surface editing operator is a CSG union operator in Table 1. The motivation to combine the teachings of Whitaker and Breen is equivalent to the motivation of claim 4.

Claims 7-9, 14-17, 19-26, 30-35 and 40 are rejected under 35 U.S.C. 103(a) as being unpatentable over Whitaker in view of Museth et al.(hereinafter "Museth", "*Level Set Surface Editing Operators*").

Regarding claim 7, Whitaker teaches a level set surface editing operator defined a speed function in section 3 right column fifth paragraph lines 1-8 ("*Thus, to summarize the essence of the (dynamic) level set approach; let ds/dt be the movement of a point on a surface as it deforms... where F is a user-defined "speed" term...*"). However, Whitaker fails to teach a regional constraint function component, filter function component, and a surface properties defining function component. Museth teaches a function that comprises a regional constraint function component, filter function component, and a surface properties defining function component on page 333 left column first paragraph lines 1-11 ("*...speed functions used in our surface editing operators...$D_q(d)$ acts as a region-of-influence function that regionally constrains the LS calculation. $C(\gamma)$ is a filter of the geometric measure and $G(\gamma)$ provides the geometric contribution of the level set surface.*"). It would have been obvious to one of ordinary skill in the art to combine the teachings of Whitaker with Museth because this combination would provide efficient modification of the surface of a model by applying variables that alter the surface geometry of the model at a certain speed, as specified by the speed function.

Regarding claim 8, Whitaker teaches that the speed function contains the term n, which is interpreted to represent a surface normal, in section 4.2 second paragraph lines ("*For the work presented here we use the mean curvature of the isosurface H to form a vector in the direction of the surface normal n...*") and as shown in equation 6. However, Whitaker fails to teach the speed function is $F(x, n, \Phi) = D_q(d)C(\gamma)G(\gamma)$. Museth teaches that the speed function $F(x, n, \Phi) = D_q(d)C(\gamma)G(\gamma)$, in equation 3, where $D_q(d)$ is the regional constraint function component, $C(\gamma)$ is the filter function component, and $G(\gamma)$ is the surface properties, as described on page 333 left column first paragraph lines 1-11. The motivation to combine the teachings of Whitaker and Museth is equivalent to the motivation of claim 7.

Regarding claim 9, Whitaker fails to teach the limitations. Museth teaches *q* being defined as a geometric primitive such as a point and notion *d* represents a distance from the level set surface model to *q* on page 333 section 4.2 second paragraph lines 1-3 ("*...d is a distance measure from a point on the level set surface to the ROI primitive q.*"). The motivation to combine the teachings of Whitaker and Museth is equivalent to the motivation of claim 7.

Regarding claim 14, Whitaker fails to teach the limitations. Museth teaches the regional constraint component defining a region-of-influence on page 333 left column first paragraph lines 1-11 ("*...$D_q(d)$ acts as a region-of-influence function that regionally constrains the LS calculation...*"). The motivation to combine the teachings of Whitaker and Museth is equivalent to the motivation of claim 7.

Regarding claim 15, Whitaker fails to teach the limitations. Museth teaches a region-of-influence that is defined by a distance calculation to a geometric primitive, on page 333 section 4.2 second paragraph lines 1-3 ("*...d is a distance measure from a point on the level set surface*

to the ROI primitive q."). The motivation to combine the teachings of Whitaker and Museth is equivalent to the motivation of claim 7.

Regarding claim 16, Whitaker fails to teach the limitations. Museth teaches a region-of-influence defined by a distance to an intersection curve point set on page 334 right column first paragraph lines 9-11 ("...*defining the region of influence based on the distance to the intersection curve shared by both input surfaces.*"). The motivation to combine the teachings of Whitaker and Museth is equivalent to the motivation of claim 7.

Regarding claim 17, Whitaker fails to teach the limitations. Museth illustrates a super-ellipsoid region-of-influence in section 5.4 first paragraph lines 5-8 ("...*the user encloses the region to be embossed with a ROI primitive e.g. a superellipsoid.*"). The motivation to combine the teachings of Whitaker and Museth is equivalent to the motivation of claim 7.

Regarding claim 19, Whitaker fails to teach the limitations. Museth teaches that the surface properties defining function component defines the behavior of the level set surface editing operator on page 333 left column first paragraph lines 1-11 ("...*speed functions used in our surface editing operators...G(γ) provides the geometric contribution of the level set surface.*")., where it is described that the speed function that applies deformation to the surface is applied to the surface of the model and therefore defines the behavior of the surface. The motivation to combine the teachings of Whitaker and Museth is equivalent to the motivation of claim 7.

Regarding claim 20, Whitaker fails to teach the limitations. Museth illustrates that the level set surface editing operator is a CSG intersection operator in Table 2. The motivation to combine the teachings of Whitaker and Museth is equivalent to the motivation of claim 7.

Regarding claim 21, Whitaker fails to teach the limitations. Museth illustrates that the level set surface editing operator is a CSG difference operator in Table 2. The motivation to combine the teachings of Whitaker and Museth is equivalent to the motivation of claim 7.

Regarding claim 22, Whitaker fails to teach the limitations. Museth illustrates that the level set surface editing operator is a CSG union operator in Table 2. The motivation to combine the teachings of Whitaker and Museth is equivalent to the motivation of claim 7.

Regarding claim 23, Whitaker fails to teach the limitations. Museth illustrates a level surface editing operator as a blending operator in the equation shown in equation 8, and the blending is shown to be constrained by a region-of-influence in Figure 5. The motivation to combine the teachings of Whitaker and Museth is equivalent to the motivation of claim 7.

Regarding claim 24, Whitaker fails to teach the limitations. Museth teaches the region-of-influence is based on the distance to an intersection curve shared by both input surfaces on page 334 right column first paragraph lines 9-11 ("*...defining the region of influence based on the distance to the intersection curve shared by both input surfaces.*"). The motivation to combine the teachings of Whitaker and Museth is equivalent to the motivation of claim 7.

Regarding claim 25, Whitaker fails to teach the limitations. Museth teaches the intersection curve is represented by a point set on page 334 right column first paragraph lines 14-16 ("*...approximate representation of the intersection curve as a point set to be sufficient for defining a shortest distance d for the region-of-influence...*"). The motivation to combine the teachings of Whitaker and Museth is equivalent to the motivation of claim 7.

Regarding claim 26, Whitaker fails to teach the limitations. Museth teaches the blending operator is defined by the function $F_{blend}(x, n, \Phi) = \alpha D_q(d)C(K)K$ in equation 8, wherein α is a

user-defined positive scalar that controls the rate of the level set calculation, $D_q(d)$ is said region-of-influence component with d being the shortest distance from the level set surface to said intersection curve point set; K is a curvature term; and $C(K)$ is a filtering function that defines the geometric properties of said blending operator on page 334 right column second paragraph lines 1-10 ("*The blending operator moves the surface in a direction that minimizes a curvature measure, K, on the level set surface...where α is a user-defined scalar...where d is the shortest distance from the level set surface to the intersection curve...where C(K) is given by Eq. (7)...*") and on page 333 section 4.3 second paragraph lines 4-6 ("*C( ) allows the user to slow and then stop the level set deformation as a particular surface property...*"). The motivation to combine the teachings of Whitaker and Museth is equivalent to the motivation of claim 7.

Regarding claim 30, Whitaker teaches a smoothing operator or term, where the surface is smoothed by applying motions in a direction that reduces local curvature in section 4.2 first paragraph lines 1-9 ("*The initialization should position the model near the desired solution while retaining certain properties such as smoothness...Given a rough initial estimate, the surface deformation process moves the surface model toward specific features in the data...the deformation process combines a data term with a smoothing term, which prevents the solution from fitting too closely to noise-corrupted data. There are a variety of surface-motion terms that can be used...*").

Regarding claim 31, Whitaker fails to teach the limitations. Museth teaches a smoothing operator is constrained to move outward relative to said surface to smooth said surface by adding material to said surface on page 334 left column first paragraph lines ("*...we can simply redefine the speed function as...max (G,0)to add material (outward motion only)...*"), as shown in Figure

7. The motivation to combine the teachings of Whitaker and Museth is equivalent to the motivation of claim 7.

Regarding claim 32, Whitaker fails to teach the limitations. Museth teaches a smoothing operator is constrained to move inward relative to said surface to smooth said surface by removing material to said surface on page 334 left column first paragraph lines ("*...we can simply redefine the speed function as min (G,0)to remove material (inward motion only)...*"), as shown in Figure 8. The motivation to combine the teachings of Whitaker and Museth is equivalent to the motivation of claim 7.

Regarding claim 34, Whitaker fails to teach the limitations. Museth teaches the blending operator is defined by the function $F_{smooth}(x, n, \Phi) = \alpha D_s(d)C(K)K$ in equation 8, wherein α is a user-defined positive scalar that controls the rate of the level set calculation,; K is a curvature term; and $C(K)$ is a filtering function that defines the geometric properties of said blending operator on page 334 right column second paragraph lines 1-10 ("*The blending operator moves the surface in a direction that minimizes a curvature measure, K, on the level set surface...where α is a user-defined scalar...where d is the shortest distance from the level set surface to the intersection curve...where C(K) is given by Eq. (7)...*") and on page 333 section 4.3 second paragraph lines 4-6 ("*C( ) allows the user to slow and then stop the level set deformation as a particular surface property...*"). Museth teaches that $D_s(d)$ ensures that said function smoothly goes to zero near the boundary of the region-of-influence on page 335 left column first paragraph lines 12-14 ("*...$D_s(d)$ ensures that the speed function smoothly goes to zero as x approaches the boundary...*"). The motivation to combine the teachings of Whitaker and Museth is equivalent to the motivation of claim 7.

Regarding clam 35, Whitaker fails to teach the limitations. Museth teaches that the region-of-influence of said is defined by a distance calculation to a geometric primitive on page 335 right column second paragraph lines 2-8 ("*...point sets can be samples of lines, curves, planes, patches and other geometric shapes...The region-of-interest function for this operator is* $D_s(d)$... "). The motivation to combine the teachings of Whitaker and Museth is equivalent to the motivation of claim 7.

Regarding claim 40, Whitaker fails to teach the limitations. Museth illustrates a level surface editing operator as appoint set attraction/repulsion operator in Figure 9. The motivation to combine the teachings of Whitaker and Museth is equivalent to the motivation of claim 7.

Claims 49 and 50 are rejected under 35 U.S.C. 103(a) as being unpatentable over Whitaker in view of Mauch ("*A Fast Algorithm for Computing the Closet Point and Distance Transform*").

Regarding claim 49, Whitaker teaches calculating the closest point on and shortest singed distance to the surface of the model by solving the Eikonal equation $| \nabla \Phi| = 1$, in section 3.2.1 first paragraph lines 5-6 – second paragraph lines 1-11 ("*...closest point on the surface S are the endpoints of this line segment...a Fast Marching Level Set Method to solve the Eikonal equation...the solution gives the signed distance from the surface S.*") and as shown in equation 13. However, Whitaker fails to teach a polygon mesh that is scan converted into a level set model by computing a distance. Mauch teaches teach a polygon mesh that is scan converted into a level set model by computing a distance, in the abstract lines 5-10 ("*We consider manifolds composed of simple geometric shapes, such as, a set of points, piecewise linear curves or*

triangle meshes...The method of characteristics is implemented efficiently with the aid of computational geometry and polygon/polyhedron scan conversion.") and on page 2 sixth paragraph lines 1-3 ("*The distance and closest point transforms are important in several applications...The distance transform can be used to convert an explicit surface into a level set representation of the surface.*"). It would have been obvious to one of ordinary skill in the art to combine the teachings of Whitaker with Mauch because this combination would provide an accurate representation of a level set model through utilizing scan conversion and closest point calculations.

Regarding claim 50, Whitaker fails to teach the limitations. Mauch teaches computing a distance volume using a CPT(closest point) algorithm in the abstract lines 1-6 ("*This paper presents a new algorithm for computing the closest point transform to a manifold on a rectilinear grid in low dimensional spaces...We consider manifolds composed of simple geometric shapes, such as, a set of points, piecewise linear curves or triangle meshes.*"). The motivation to combine the teachings of Whitaker and Mauch is equivalent to the motivation of claim 49.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Said Broome whose telephone number is (571)272-2931. The examiner can normally be reached on 8:30am-5pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Ulka Chauhan can be reached on (571)272-7782. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

S. Broome
8/14/06 SB

ULKA CHAUHAN
SUPERVISORY PATENT EXAMINER